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December 1954, iii+58 pp. (EF)

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FAO Plant Protection Bulletin

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World Reporting Service on Plant Diseases and Pests

The Diseases of the Cinchona Tree

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United States Operations Mission to Cuba, Havana

The Era of Exploitation

The cinchona tree has figured in the annals of horticultural and medical science for three hundred years.. For a little over 200 years – from 1650, when quinine from the bark of the wild South American cinchonas first became an accepted remedy for malaria, to 1866 – little was known about the tree and nothing about its disease problems. Some few fungi were collected and described from the commercial barks that were produced by the wild trees and received in European markets.

Eastern Hemisphere Plantation Culture

In 1866 seeds of the Bolivian *Cinchona officinalis* L., stolen by an agent of Charles Ledger, germinated in Java to furnish the beginning of the plantation culture of the Ledger variety, called by the Dutch *C. ledgeriana* Moens. From the start this cinchona, with the highest quinine-containing bark ever found, was attacked by various diseases. To overcome a weakness to root diseases, the so-called red cinchona, *C. pubescens* Vahl., was introduced as a root stock. With varying degrees of success and many failures, plantation culture was tried in Africa, Ceylon, Formosa, India, Indochina the Philippines, Jamaica, Malaya and the Netherlands Indies.

Seedbed diseases, principally caused by *Rhizoctonia solani* Kuehn, caused heavy losses and were difficult to control in the heavily-shaded seedbeds in which cinchona was grown. In transplant beds, dieback diseases have occasioned the greatest concern. In Java these losses were attributed to *Diplodia theobromae* (Pat.) Nowell, in Formosa to *Phytophthora cinchonae* Sawada, and in the Philippines and India to *P. palmivora* Butl. In Malaya a collar rot was found to be due to *P. cinnamomi* Rands and a similar disease in Burma to *Sclerotium rolfsii* Sacc.

Once established in plantations the disease problems of the cinchona have been many and varied. Outstanding, as regards both distribution and losses, have been the stem canker or pink disease caused by *Corticium salmonicolor* Berk & Br., stripe canker caused by *Phytophthora palmivora*, and the root diseases. Of these most commonly mentioned are *Armillaria mellea* Vahl. ex Fr. causing root canker, *Fomes noxius* Corner, causing brown rot, *F. semitostus* Ber. and *F. lignosus* Bres., causing white rot, *Rosellinia arcuata* Petch and *R. bunoides* (Berk & Br.) Sacc. causing grey root rot, and *Ganoderma pseudoferreum* (Wakef.) v. Over. & Steinm., causing red rot.

For present purposes this 75–year era of plantation culture came to an abrupt end with the outbreak of World War II in the Pacific. Some 290 publications, the first dated 1878, are listed in U.S.D.A. Bibliographical Bulletin No. 9, which reviews the literature on cinchona diseases of this period. This publication was issued by the U.S. Bureau of Plant Industry as a contribution to aid the intensive development of American cinchona plantations following the loss of East Indian sources of quinine.

Western Hemisphere Plantation Culture

Soon after Pearl Harbor, along with exploitation of wild cinchona bark, plantation development was stimulated in Bolivia, Peru Ecuador, Costa Rica, Guatemala and Puerto Rico. Much of this development used as planting stock cinchona seedlings grown from seed obtained from the Philippines just before they were invaded by Japan, or from expropriated Japanese plantations in Peru. The planting stock was the now highly-selected Ledger variety returned to its original home after almost 75 years' absence. It was soon apparent that disease problems would prove a limiting factor in most of the plantations. A few sites, where native *Cinchona officinalis* trees were used as planting stock, remained free of parasite-induced diseases. In general, adequate control measures were developed where needed.

With the exception of the Merck & Co. plantations in Central America, where their own pathologist was maintained, and in Puerto Rico, where investigations were undertaken by the U.S. Bureau of Plant Industry, the disease investigations were carried out by pathologists of the Office of Foreign Agricultural Relations, U.S. Department of Agriculture, supported by funds variously provided by the U.S. Board of Economic Warfare, the U.S. Foreign Economic Administration, U.S. Interdepartmental Committee on Scientific and Cultural Cooperation and, in its final phases, by the U.S. Technical Cooperation Administration (Point IV).

Diseases of the damping-off type seldom have been more than a nuisance. Generally the Ledgeriana type and *Cinchona officinalis* were more susceptible to loss soon after germination. In contrast, varieties of *C. pubescens*, and in Peru *C. micrantha* Ruiz & Pavon were more susceptible as they became older. Where determined, the responsible pathogen was found to be *Rhizoctonia solani*. In Bolivia, no losses were recorded in seedbeds, consisting only of a patch of cleared jungle soil, on which seeds were broadcast in expectation of starting a plantation on the site the following year. In other countries, where seedbeds were carefully made from sifted mixtures of sand, clay and humus, damping-off usually made its appearance first in a few isolated centers. Unchecked, the disease would spread rapidly and devastate the moist, heavily-shaded beds. In practice, immediate application of Spergon Wettable, in water suspensions of 1 gram per square foot, gave perfect disease control. Applications of Cuprocide and Bordeaux mixture were also recommended.

In the transplant beds, top blight or top wilt caused by *Phytophthora parasitica* Dast. resulted in heavy losses. The fungus, apparently its zoospores, first attacked leaf tissue and then entered at the growing point or along the shoot by way of the petiole. In different phases of this same disease in the plantation this pathogen is responsible for top blight in Costa Rica and Peru and girdle canker in Guatemala. The disease does not, however, appear to be necessarily of nursery origin. Destruction of infected plants as soon as observed and regular spraying with Bordeaux mixture have kept the disease under control in the nursery. The disease may be recognized by wilted, blackened tops or in earlier stages by water-soaked lesions or shrunken, blackened areas on the leaves. While the disease is found on *Cinchona pubescens*, it is only on the Ledgeriana types and on *C. officinalis* that it is a factor. Heaviest losses occur when recently-grafted material is attacked.

Root rot caused by *Phytophthora cinnamomi* Rands has occurred in the transplant beds in Peru and Guatemala. Except in poorly-drained areas the disease was of little importance at this age. However, strong evidence exists that this pathogen, responsible for some plantation root rot in Peru and Costa Rica and for stripe-canker in Guatemala, is carried from the nursery to clean plantation sites on the trees. On transplant-age material the disease generally occurs as a dry, brown-colored rot of the smaller roots. In advanced stages, above-ground symptoms are foliage chlorosis or reddening followed by loss of all but the small terminal leaves. Control has consisted in selection of disease-free nurseries. While some differences exist, all species and varieties of cinchona concerned in plantation culture are sufficiently susceptible to be infected under some conditions.

Sclerotium rolfsii has caused occasional losses from collar rot in the Peruvian nurseries. Trees become immune with advancing

age, making it unnecessary to do more than retard the spread of the fungus. Effective control may be obtained by removing infected trees and the soil surrounding them from the nursery. The disease may be recognized by its spotty appearance and by the presence of white mycelium and abundant sclerotia on the soft, wet, decayed collar area on the surrounding soil.

Leaf diseases, even though the cinchonas are peculiarly sensitive in the reaction of their foliage to changing conditions, have been of little importance. Chlorosis, both as a direct result of root or collar rot and as a response to mineral deficiencies and excess alkalinity, is of common occurrence. Abnormal appearance of reddish color in the leaves, for similar reasons, likewise has been common. In Puerto Rico only, a suspected virus disease has been observed.

Red algal leaf spot, *Cephaleuros virescens* O. Kunze, is commonly found on all varieties. The disease, characterized by circular, raised, reddish-brown spots on the upper leaf surfaces, is of no economic importance. Occasional green algal leaf spots, equally harmless, have been reported from Peru.

Thread blight, *Pellicularia koleroga* Cke., has been observed in limited amounts in both Central and South American plantations. For unexplained reasons attacks have never been as severe as on the closely-related coffee, even where cinchona plantings have been located near diseased coffee. Thread blight is characterized by the presence of mycelial strands running up the trunk and out along the branches and by clusters of dead leaves held to the shoots by strands of mycelium. A very similar disease, horsehair blight caused by *Marasmus* sp., was found in Colombia on *Cinchona barbacoensis* Karst. This disease differs principally in that it causes larger. darker mycelial strands.

A leaf spot associated with reddening and premature defoliation has been found only in Costa Rica on *Cinchona pubescens*. This disease is caused by *Prillieuxina cinchonae* Stevenson. Infected areas are described as black, circular, up to 1 cm. in diameter, and often coalescing, when along the secondary veins, to form lineal areas from 2 to 6 cm. long extending from margin to midrib.

Scab, *Elsinoe cinchonae* Jenkins, has been found on *Cinchona pubescens* and occasionally on *C. officinalis* in Colombia and Peru. Scale-like cinnamon-colored cankers are present on young stems and the branches of the inflorescence. The capsules themselves are attacked and become dwarfed and abnormally curved. Lesions are more numerous on the capsules than they are on stems and branches raised and differ only slightly in color from healthy surrounding tissue. On the leaves, spots 0.5 to 1.5 mm., in length, are usually concentrated on or near the veins or margins of the leaves. Spots are cinnamon-colored and darker brown when covered with fructifications of the pathogen.

Bark diseases of the type which, through corking, cracking or production of other deformities, would make harvesting difficult have rarely been seen. In Peru and in Guatemala a rough bark condition has been observed. In the latter eradication was so complete that the cause was never determined. Lichen infections are common, and where the bark is sold for use in the curing of wine the barks so infected bring the best prices.

Branch cankers and top dieback have been of common occurrence wherever the plantations were located in areas bathed by fog. The plantation phase of the *Phytophthora parasitica* dieback is found on both *Cinchona officinalis* and *C. pubescens* wherever these varieties are grown and on wild *C. pitayensis* in Colombia. The disease is characterized by the infection, blackening and death of the tips of the branches and younger leaves. Infections build up slowly in a single tree and then give the appearance of spreading from crown to crown into healthy trees. Eradication, as soon as recognized, has been found to be the only method giving any degree of control.

The pink disease, *Corticium salmonicolor*, is characterized by the presence of cobwebby, pink mycelium on infected areas of all cinchona varieties. Unlike the preceding, only an occasional branch or portion of a tree is attacked. The disease may be suspected when a portion of the top of a tree dies while the remainder is unaffected. The disease is most severe in dense stands in damp locations. Careful removal of diseased branches, often during regular pruning operations, helps to keep the disease under control.

Girdle canker is a highly-specialized variation of the top dieback disease caused by *Phytophthora parasitica*. It has caused heavy

losses in Guatemala and Costa Rica on grafted material. The union between the Ledger or *Cinchona officinalis* scion and the *C. pubescens* stock is a reasonably good one. However, considerable production of suckers or watersprouts regularly occurs from the scion just above the graft union. These fast-growing shoots are soft and furnish an ideal point for the top dieback organism to attack. Once in the sucker, the fungus spreads down its stem to the trunk of the tree, enters the tissue just adjacent to the stock and then rapidly girdles the tree. The cambium and phloem tissues of the girdled area are light brown in color. Externally the girdled area may be located as a sunken area on the trunk, delimited on the lower side by the graft union but of indefinite extent of some inches on the upper. Such girdled trees die suddenly and often may be observed with their foliage completely wilted. Effective control apparently can be secured by the prevention of inoculum reaching the susceptible area and by the destruction of suckers, either mechanically or by herbicides.

Root and collar-rot diseases have been unusually severe and numerous on plantation-grown cinchona. Root disease, caused by *Phytophthora cinnamomi*, was carried to the plantations in Peru from the nursery and accounted for some portion of the heavy losses at first experienced. On seedling *Cinchona officinalis*, and Ledger-type trees, this disease was mainly confined to the smaller roots. Only in a few cases was this fungus isolated from collar infections. However, in Guatemala on grafted material, this same fungus produced stripe canker. This disease is characterized by cambium and phloem infections extending from the roots up the trunk in narrow streaks. More than one infection may be present and streaks may extend up to the top of the tree. Externally the disease may be recognized by the vertical streaks of sunken bark. No control has yet been developed but at least one disease-resistant clone has been located which may make it possible to disregard this particular pathogen.

In Peru, a collar-rot disease, caused by *Phytophthora quininea* Crandall, was responsible for heavy losses in plantations established with seedling Ledger-type trees and *Cinchona officinalis* selections brought in by Japanese colonists. The disease was not found in plantations established entirely with *C. officinalis* trees of local origin, although these selections were found by inoculation to be susceptible. Externally the disease could be recognized by a swollen area in the trunk some six inches above the soil line. This corresponds with the top, internally, of a reddish-brown infected zone in the phloem and cambium tissues. Infected trees are characterized by thin, usually reddish-colored foliage and in later stages of disease by loss of all but the terminal leaves. This disease was apparently carried to the plantations originally from the nursery. Deep planting was also found to be the condition predisposing the trees to attack. Production of clean nursery stock and development of better planting methods reduced incidence of the disease from 75 percent to less than 15. First attempts to overcome the disease through use of *C. pubescens* root stocks were unsuccessful since this species is more susceptible to the root disease than *C. officinalis*. *Armellaria mellea* is regularly encountered on root-diseased cinchona. Apparently it is seldom a primary parasite, although responsible for losses when its host is growing under adverse conditions. In Peru it is regularly followed by *P. cinnamomi* and *P. quininea* and, because of the easily visible white mycelial fans between bark and wood, was often considered responsible for the losses. Both in pure culture and on the host, the mycelium of *A. mellea* fluoresced after exposure to artificial light.

In Guatemala and Puerto Rico grey root rot, caused by *Rosellinia* sp., has caused some losses. Infection by this fungus is characterized by general decay of the roots, usually of trees closely adjacent to one another, and the presence of webs of dark grey mycelium on the roots and collar. Control has consisted in uprooting the trees and utilizing the site, at least for a time, for other crops. Some evidence exists that this disease is more prevalent on old coffee soils or near coffee.

Physiological root rot was responsible for the loss of millions of plantation-grown local *Cinchona officinalis* trees in Bolivia. Through a mistaken idea as to the requirements of the tree, plantations were established by planting in the bottom of a hole several feet deep. Trees so planted eventually had roots growing

upwards into the surface soil, but succumbed to the combined effects of bacterial action and the girdling effect of the root ball which developed. Most striking aspect of the disease was the correlation with age of the progressing symptoms of decline, from the first appearance of reddish color on the foliage to final loss of most of the leaves.

Plant Disease Situation in the United States [1]

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Eggplant a Host for Potato Golden Nematode

INVESTIGATIONS on Long Island, New York, have shown that the golden nematode (potato root nematode) of potatoes, *Heterodera rostochiensis* Wollenweber, can attack and reproduce on eggplant (*Solanum melongena*). Previously, potato and tomato were the only commercially important plants on which the golden nematode was known to be able to complete its life cycle. Hatching and emergence of infective larvae were demonstrated from cysts exposed to leachings from eggplant roots and from cysts in soil containing growing eggplant roots. The complete cycle of growth and reproduction took place on eggplant roots. The dimensions of cysts, eggs and larvae from eggplant were within the ranges reported for the golden nematode. There were no morphological differences between cysts, eggs and larvae grown on eggplant and the corresponding stages grown on potato.

Wheat Streak Mosaic Found in Washington

Wheat streak mosaic was found in wheat–breeding nurseries in Washington State in June 1954. This appears to be the first report of a virus disease on wheat in the Pacific Northwest.

The disease was first noticed when a severe outbreak developed in portions of the winter and spring wheat-breeding nurseries, to which it appeared to have spread from winter wheat growing in a roadway adjacent to the plots. Nearly all the plants adjacent to the roadway were diseased, and there was a gradual diminution of infection away from the apparent source.

The symptoms were virtually identical with those described for wheat streak mosaic. On the leaves they varied from faint chlorotic streaks, through more intense yellow streaking and mottling, to chlorosis of the entire leaf surface. Most of the affected plants were more or less stunted, the amount of stunting evidently depending upon the reaction of the variety or upon the age of the plant at the time of infection.

Inoculum from diseased leaves showing typical streak-mosaic markings was used to inoculate greenhouse-grown seedlings of Michigan Amber wheat, smooth crabgrass (*Digitaria ischaemum*), Golden Giant sweet corn (*Zea mays*), and lambsquarters (*Chenopodium album*). Culture after inoculation was in a greenhouse during late July and August, with the daily maximum temperature ranging from 85° to 93° F. Systemic signs were expressed in all of the 56 wheat seedlings on the 4th to the 8th day; in all of the 10 smooth crabgrass seedlings on the 7th to the 9th day; and in 12 out of the 21 sweet corn seedlings on the 7th to the 18th day following inoculation. The lambsquarters plants did not become infected.

Infection in wheat at high summer temperatures, and infection in smooth crabgrass and in sweet corn, rules out the known soil-borne cereal viruses. Lack of infection in lambsquarters eliminates the barley stripe-mosaic virus and brome grass-mosaic virus. The symptoms were typical of those induced by the wheat streak-mosaic virus and did not suggest those induced by the barley stripe-mosaic virus or the brome grass-mosaic virus in greenhouse culture.

Stripe mosaic (false stripe) of barley was present in an adjacent barley nursery. Inoculations were also made on wheat plants with this virus, and these plants developed stripe-mosaic symptoms within 10 days.

[1] This report is based upon material submitted by Collaborators of the Plant Disease Epidemics and Identification Section, Agricultural Research Service, United States Department of Agriculture, Beltsville, Maryland.

A brief survey of wheat and barley fields in the Pullman area of Washington failed to disclose the presence of streak mosaic or stripe mosaic; it therefore appears possible that the 1954 infestation in this region was confined to the breeding nurseries.

Cercosporella Foot Rot of Wheat in New York State

The isolation of *Cercosporella herpotrichoides* Fron from Cornell 595 wheat collected in Tompkins County New York, 1 June, 1953 is apparently the first report of the occurrence of this foot rot in the eastern part of the United States.

For comparison, a specimen of wheat affected by *Cercosporella* foot rot was obtained from the State of Washington. Symptoms of the disease on wheat grown in New York are similar to those on the Washington material. The lesions occur on the lower portion of the culm, underneath the leaf sheaths. New York material collected early in the spring also exhibited well-defined lesions on the lowermost leaf sheaths. The margin of the elliptical lesions formed on the base of the stem is brown and the central portion is light tan. The most conspicuous macroscopic sign is a brown stroma that forms on the central portion of the lesion. Comparison of the fungus isolated from the Washington specimen with the New York isolate showed no essential difference between the two isolates.

Pathogenicity of the New York isolate was demonstrated by inoculating greenhouse-grown plants of Cornell 595, Genesee, and Yorkwin wheats and Mohawk oats. Symptoms produced on the plants grown in the greenhouse were like those observed on wheat plants naturally infected in the field. *C. herpotrichoides* was reisolated from the artificially inoculated plants.

Among Cornell Herbarium specimens of wheat affected by foot rot organisms one specimen was found labelled *Rhizoctonia solani* Kuehn, but with stromata characteristic of *Cercosporella herpotrichoides*. Lesions caused by these two fungi are similar and the diseases could easily be confused without careful examination. It appears that this specimen, on Yorkwin wheat collected 20 June, 1944, is the earliest New York collection of the *Cercosporella* foot rot fungus on wheat.

A survey of some western and central New York winter wheat fields was made in May, June and July, 1954. Symptoms of *Cercosporella* foot rot were seen on wheat in 25 counties visited and in almost every field examined. Of fifty isolates with growth habits like those of *C. herpotrichoides*, obtained from cereal plants collected during the survey, 16 so far have sporulated; they all confirm the initial identification.

Mastigosporium Leaf Spot on Alopecurus in New York [2]

The fungus *Mastigosporium album* Riess has been reported in Wales and England, in central Europe, Scandinavia and Russia.

In early June 1954, a leaf spot was observed on meadow foxtail (*Alopecurus pratensis*) growing near Ithaca, New York. The spots appear on the leaves as elongate purplish brown areas, 1 to 2 mm. in length and about half as wide, often surrounded by a cloronemic zone. Each spot has in its center a minute white fleck which may occur on either side of the leaf. This superficial white fleck represents the spores of *Mastigosporium album*. The spores are very characteristic and in the New York specimens appear identical to those on *Alopecurus pratensis* in exsiccati collections. No previous record of *M. album* in the United States has been found.

Occurrence of an Unusual Virus Disease of Lettuce in California

In October 1953 a hitherto unreported disease was observed in a 15-acre field of Great Lakeshead lettuce in the late rosette stage, in the Salinas Valley of California. Infection was confined for the most part to a strip not more than 200 feet wide running diagonally through the field. Within this strip the infection varied from 5 to 25 percent. Inspections were made periodically until harvest, but no further spread was noted either within the field or to adjacent fields. Wild and cultivated plants within the immediate area were also examined, but no potential sources of inoculum were found.

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[2] Information received from the Department of Plant Pathology, Cornell University, Ithaca, New York.

Affected plants exhibited a variety of symptoms, for the most part on the older and intermediate leaves. These symptoms ranged from a diffuse yellow mottle with yellow ring spots to a brilliant yellow or white calico-like pattern. No necrosis was observed initially, but the infected leaves later developed a dull yellow color and some of them died. Most of the infected plants were severely stunted with the result that heads were so greatly reduced in size as to be unsuitable for harvest.

The symptoms and pattern of distribution in the field suggested that the disease might be due to a virus. Inoculation from infected plants to *Nicotiana glutinosa*, *N. tabacum*, *N. rustica*, petunia, cowpea and Bountiful bean produced symptoms in these host plants that agreed closely with those reported for tobacco-ringspot virus. Reinoculations from these hosts to head lettuce varieties gave symptoms identical with those observed in the field.

Infection of wild lettuce and head lettuce following artificial inoculation with tobacco-ringspot virus has been reported previously, but the leaf symptoms described did not include calico-like patterns and ringspotting.

There does not seem to be any previous report of the natural occurrence of a tobacco ringspot-like virus in head lettuce.

Control of Carnation Rust with Fungicides in Italy

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RUST disease caused by *Uromyces caryophyllinus* is the main fungus disease of carnations in Italy, causing more damage than other carnation diseases of common occurrence, such as wilt (*Fusarium dianthi*), leaf and stem spot (*Alternaria dianthi*) and flower discoloration (*Alternaria dianthicola*). The extremely wide dispersion of the rust disease may be a result of liberal watering of the plants, which facilitates the infection and spread of the pathogen by keeping the foliage wet and scattering the spores. Although no statistical data are available, the annual losses caused by this disease are undoubtedly of high economic importance.

The standard treatment against the rust disease practiced in Italy has been the application of Bordeaux mixture with a copper sulfate content of 1 to 2 percent. The treatment begins in July, continues until the end of October, and proceeds again from the end of January until March or April, with applications at intervals of 20 days. The average result has not been satisfactory because the control is only partially effective; in addition the sprayed plants appear sordid and the flowers are not fully marketable.

In the hope of finding better methods for controlling the rust disease, experiments were carried out in a carnation planting at San Remo on the Italian Riviera, the center of carnation growing in Italy. Three newer fungicides were used as sprays, in addition to Bordeaux mixture. Six sprayings were applied, from the end of June to November, on Franca, a variety which has pink flowers with red spots and is highly susceptible to rust. Each treatment covered 100 plants. Applications, totaling 6, were made at intervals of about 20 days. The fungicides used were as follows:

1. Dithane Z–78 (zineb; zinc ethylene bisdithiocarbamate), 0.3 percent concentration.
2. Dithane D–14 (nabam; disodium ethylene bisdithiocarbamate), 0.5 percent concentration, with 0.1 percent zinc sulfate added.
3. SR–406 (captan; N–trichloromethyl-thiotetrahydrophthalimide), 0.3 percent concentration.
4. Bordeaux mixture, 1–2 percent copper sulfate.

Except for Bordeaux mixture, 0.2 percent of Triton X–100 was added to all the fungicides in order to assure a good coverage. One hundred leaves were examined from each group of treated plants to determine the extent of infection. The results are summarized in Table 1.

Table 1. *Effectiveness of various fungicides for the control of carnation rust*

Fungicide used	Number of leaves infected out of 100 examined	Total number of pustules		
		Lower surface	Upper surface	Both surfaces
Dithane Z–78	10	30	24	54
Dithane D–14	16	94	84	178
SR–406	23	96	91	187
Bordeaux mixture	62	248	211	459
Check	72	579	520	1099

These results indicate that Dithane Z–78 is the most effective of the treatments tested for the control of rust on carnations. Its fungicidal action appeared to be greatest, and it has the advantage, together with Dithane D–14, that residues do not show on the stems and leaves. It is suggested that, as a practical schedule for treatment of carnation plants, applications should be made at intervals of 20 days from the end of July to the end of November, for control of rust in the field under conditions on the Italian Riviera, preceded by two or three treatments, at intervals of 10 to 15 days, when plants are in the nursery during the February–April period.

INTERNATIONAL PLANT PROTECTION CONVENTION: ITS PRESENT STATUS

It is regretted that the information regarding the status of the International Plant Protection Convention given on page 16 of the October 1954 issue of the Bulletin (Vol. III, No. 1) was inaccurate and incomplete. Those governments which have ratified or adhered to the Convention up to 31 December 1954, with the effective dates of their instruments of ratification or instruments of adherence, are as follows:

Argentina	23 September 1954
Australia	27 August 1952
Austria	22 October 1952
Belgium	22 July 1952
Cambodia	10 June 1952
Canada	10 July 1953
Ceylon	3 April 1952
Chile	3 April 1952
Denmark	13 February 1953
Dominican Republic	20 June 1952
Egypt	22 July 1953
El Salvador	12 February 1953
Greece	9 December 1954
India	9 June 1952
Iraq	1 July 1954
Japan	11 August 1952
Korea	8 December 1953
Netherlands	29 October 1954
New Zealand	16 September 1952
Pakistan	10 November 1954
Republic of the Philippines	3 December 1953
Spain	3 April 1952
Sweden	30 May 1952
United Kingdom	7 September 1953

Outbreaks and New Records

Denmark

ERNST GRAM
Statens plantepatologiske Forsog, Lyngby

THE present notes summarize briefly the highlights of the situation of plant pests and diseases in 1954.

Weather conditions were adverse in most parts of the country. Much wheat, especially the non-Scandinavian varieties, died in the winter, and cruciferous and beet seed fields suffered a great deal of damage. It was late spring before sowing was possible and emergence was delayed by a drought in May. Summer and autumn brought very abundant precipitation and a constantly damp atmosphere. Grazing was good, but the seeds of root crops, of clovers and of grasses were nearly ruined; cereals ripened unevenly and harvest was difficult. Blasting in grass seed was apparently due to night frost.

Cereals

Manganese deficiency in winter wheat and rye, partly due to over-intensive soil cultivation, was controlled by spraying with manganese sulfate, at a rate of 8-15 lb. per acre. Copper deficiency, widespread and often serious in oats, was widely cured by spraying with copper sulfate, at a rate of 15 lb. per acre.

Root crops

Extensive root-rot and other germination troubles must be attributed largely to the adverse germination conditions, but they are nevertheless aggravated by neglected rotation – there has been for many years a marked tendency to reduce the acreage in fallow, while reducing permanent pasture slightly and increasing root crops. Early and serious attacks of *Aphis fabae* were a further setback for the crops. Virus yellows was rather common, but mild; results of spraying or dusting against aphids were satisfactory, even against the virus yellows, this latter to a large extent being spread from fodder beets kept in clamps until June.

Chortophila floralis was, as in 1953, destructive to swedes in some parts of the country; experiments in chemical control have on the whole been disappointing. Current biological investigations prove that periods of emergence and oviposition vary greatly from one region to another. In the case of *Psila rosae* application of parathion early in the season proved very efficacious.

Potatoes

A thorough sampling of commercial nurseries for *Heterodera rostochiensis* showed that these areas were free from cysts – and potato growing in nurseries is forbidden. On the other hand, inspection of numerous allotments has shown that the nematode is too widespread there; rules have been laid down which enable nurserymen and farmers to protect their premises from infestation due to reckless potato growing by neighbors. The southern regions of the country were threatened by a fairly widespread invasion by the Colorado beetle, but the numbers found in individual localities were minimal and it is expected that intensive eradication measures, as in earlier cases, will prove 100 percent efficient.

Fruits

The appearance of apple scab, *Venturia inaequalis*, was delayed in the dry spring, and the modern fungicides gave satisfactory control. Russeting of apple fruit, partly due to spraying, but sometimes worse in unsprayed

check trees (weather russet), is not alarming but constitutes an intriguing problem where scab has already been mastered. The nematodes *Aphelenchus ritsema–bosi* and *A. fragaria* are rather common in strawberry, but hot-water treatment of runners has proved profitable and is being applied in production of certified plants.

Northwestern Africa

O. B. LEAN
Technical Assistance Program, FAO, Rome

The Desert Locust Outbreak

During the autumn of 1954 there occurred a major migration of desert locust swarms into northwestern Africa and adjacent areas. In late September and early October, young swarms appeared from Chad Territory to Mauretania and Spanish Sahara. In mid-October, a strong northwesterly movement led to an invasion of the coastal areas of Spanish Sahara and the Canary Islands. During the same period great numbers of dead locusts were reported in the sea from south of Cape Verde to the latitude of Lisbon and some scattered locusts reached southern Spain, the Scilly Isles and southern Ireland.

The invasion of French Morocco by numerous dense swarms commenced 25 and 26 October. On 1 November, the majority of these swarms were carried over the anti-Atlas Mountains to invade the Souss Valley, with devastating results. During November and December dense immature swarms remained in northwestern Morocco and in December swarms crossed the western High Atlas, to invade the lowlands to the north.

United States

Plant Pest Control Branch
Agricultural Research Service
United States Department of Agriculture

White-fringed Beetle and Walnut Husk Fly in New Areas

The white–fringed beetle was reported from New Jersey for the first time during November 1954. Specimens taken from infested sweet potatoes, grown in Cumberland County, New Jersey, were identified as *Graphognathus leucoloma* race *imitator* Buch. Prior to this discovery, this serious pest of several important agricultural crops was not known to occur in the United States north of eastern North Carolina.

The walnut husk fly (*Rhagoletis completa* Cress) has been found for the first time in the State of Washington and in northern California. The California occurrence involves an important commercial walnut area; however, the Washington infestation, located in the City of Yakima, is not of economic importance as no walnuts are commercially produced in that area.

Plant Quarantine Announcements

Austria

Plant Import Ordinance of 5 August 1954 revokes and replaces Order No. 246 of 5 October 1949, containing the following more important provisions concerning the importation and transit of plant materials.

Imports prohibited.

1. Any object which carries and may spread a dangerous plant pest or disease.
2. Soil, manure and compost.
3. Rooted carnations or carnation cuttings.
4. Cut carnations from 15 March to 30 November.
5. Plants of oak (*Quercus*), edible chestnut (*Castanea*), elm (*Ulmus*) and poplar (*Populus*); also cuttings, slips, grafts and other barkcovered parts of those plants.
6. Beet and mangold plants (*Beta*), except seeds and beet roots with their tops cut off.

Imports restricted.

1. Pome fruit requires a certificate of origin and health, certifying freedom from dangerous pests and diseases, especially San José scale (*Quadraspidiotus perniciosus*), Mediterranean fruit fly (*Ceratitis capitata*) and apple fruit fly (*Rhagoletis pomonella*).
2. Stone fruit requires a certificate of origin and health, certifying freedom from pests and diseases, especially San José scale and Mediterranean fruit fly.
3. Citrus and banana fruits require a certificate of origin and health, certifying freedom from pests and diseases, especially Mediterranean fruit fly.
4. Potatoes require a certificate of origin and health, certifying freedom from soil and dangerous pests and diseases, especially potato wart (*Synchytrium endobioticum*), Colorado beetle (*Leptinotarsa decemlineata*) and potato tuberworm (*Phthorimoea operculella*) and attesting that wart disease has not been found within 2 km. of the place of origin for the last five years. Small quantities of soil adhering to potatoes, not enough to shelter pests, will be permitted. Seed potatoes must be shipped in unused sacks and certified with regard to the variety and official grade.
5. Fruit trees and shrubs, including all propagating materials, require a certificate of health and origin, indicating freedom from dangerous pests and diseases, especially San José scale and virus diseases, and that conditions specified in the import permit have been fulfilled.
6. Deciduous and evergreen trees and shrubs (except those specifically prohibited and fruit trees), including all propagating materials, require a certificate stating that such woody plants are free from dangerous diseases and pests, especially San José scale.
7. Vines, including cuttings, layers and grafts, must be certified as being free from dangerous diseases and pests, especially phylloxera.
8. Strawberry plants and shoots require a certificate indicating freedom from dangerous diseases and pests, especially virus diseases, and certifying that the field of origin is free from virus diseases and strawberry mite (*Tarsonemus fragariae*).
9. Flower bulbs and tubers require a certificate indicating freedom from soil and dangerous pests and diseases, especially *Pseudomonas hyacinthi, Sclerotinia bulborum, Sclerotium tuliparum, Botrytis tulipae*, nematodes (*Aphelenchoides* spp., *Tylenchus* spp., *Heterodera* spp.), *Merodon equestris, Eumerus strigatus, Rhizoglyphus echinopus* and Thysanoptera. Azaleas should be certified for freedom from *Septoria azaleae, Exobasidium azaleae, Gracilaria azaleela* and *Acalla schalleriana*.
10. Other rooted crops and roots, bulbs, rhizomes etc. (excluding vegetables) require a certificate of origin and health.
11. Plants and parts of plants from non–European countries (except those bordering the Mediterranean) require, in addition to the requirements specified above, a certificate of origin and health, indicating freedom from dangerous diseases and pests and certifying that Japanese beetle (*Popilla japonica*) has not been found within 50 km. of the place of origin. This restriction does not apply to cereals, pulses and other seeds, kiln–dried and dried plants and parts thereof, milling products, preserves and other plant products.

Exemptions.

Exemptions to the prohibitions and restrictions mentioned above are granted in the following cases:

1. Products of holdings situated over the border but cultivated by residents within the border.
2. Foodstuffs carried by means of international transportation.
3. Fruit up to 15 kg. and potted flowers carried by tourists.

Inhabitants of border-districts, upon application, may also be given permission to import potatoes from the neighbouring states.

The Federal Ministry of Agriculture and Forestry may allow the import or transit of prohibited or restricted plant materials if there is no risk of introducing pests and diseases.

Transit.

The restrictions specified above are applicable to plant materials in transit. A transit permit is required to take the place of the import permit. However, the restrictions do not apply to consignments if they are in transit on the basis of bills of lading and contained in undamaged sealed containers or in sealed rail waggons.

Certificate.

The certificate of origin and health accompanying the restricted plant material must be in conformity with that required by the International Plant Protection Convention of 1951 and must be issued within 3 weeks before the shipment. A German translation must accompany the certificate.

Import or transit permit.

Application for a permit should be made to the Federal Ministry of Agriculture and Forestry in Vienna. The application for an import permit should indicate the address of the consignee, source of supply, the quantity and type of plants, and whether the plants will be used by the buyer. The application for a transit permit should indicate the address of the consignee, source of supply, quantity and type of plants, type of packing and points of entry and exit.

Federal Republic of Germany

Ministerial Decree of 13 November 1954, published in the *Bundesanzeiger* No. 225, 23 November 1954, authorizes the importation of flowers, buds, twigs and other fresh parts of woody plants for wreath and ornamental purposes from 15 November 1954 to 14 April 1955. The effect of this new Decree is to provide for exemption from the prohibition laid down in the Ordinance of 3 November 1931 concerning San José scale and apple fruit fly. However, if the German Inspection Service finds repeatedly such materials infested by the San José scale (*Aspidiotus perniciosus*), this exemption may be withdrawn.

The phytosanitary certificate must conform with the provisions of the Ordinance of 3 November 1931. If the consignment has been fumigated or otherwise suitably disinfested, the type of treatment, the chemicals and concentration used, and the methods and duration of treatment, must be indicated on the certificate.

Italy

Ministerial Decree of 19 July 1954, published in the *Gazzetta Ufficiale*, Vol. 95, No. 189, 19 August 1954, revokes the Ministerial Decree of 18 September 1953. It prohibits the transport of sugar beet plants or parts of plants from communes declared to be infested by the beet weevil (*Temnorhinus mendicus* = *Cleonus mendicus*) to non-infested communes. There is no reference in this Decree to the importation of sugar beet plants.

Madagascar

Order No. 245-SE/AGR-CG governing the importation of seeds of cultivated plants, dated 18 October 1954 and published in the *Journal Officiel de Madagascar et Dépendances* Vol. 70, No. 3644, 30 October 1954, prohibits the importation of seeds or cuttings of botanical samples, except under the following conditions.

Any individual or administrative service wishing to import such material must apply for an authorization of importation in advance from the Chief of the Division of Plant Protection. The application must indicate the name of the plant and the variety, the place of origin, the name and address of the supplier, the quantity to be imported and the place in Madagascar where the acclimatization trials will be carried out. The authorization will be granted only in respect of the plants belonging to genera or botanical varieties which do not exist in the collections of agronomic stations of the Agricultural Service, and such plants may be imported only in limited quantities required for the trials. They must be accompanied by phytosanitary certificates in accordance with the regulations in force and on arrival they will be inspected, treated and possibly quarantined. If found infested, they will be destroyed. The inspection and treatment will be carried out at Tananarive.

The provisions of this new Order do not modify in any way the provisions in the regulations in force relating to the importation of certain specific seeds.

New Zealand

Notice No. Ag. 5780 of 22 November 1954, issued by the Director of the Horticulture Division, Department of Agriculture, and published in the *New Zealand Gazette* No. 72, 25 November 1954, authorizes the introduction without a permit of nursery stock of the following plants:

Frangipani plants (*Plumeria acutifolia* and *P. rubra*)
Bromeliad (all species of Bromeliaceae)
Saintpaulia plants (*Saintpaulia* spp.)

Lapageria plants (*Lapageria rosea*)
Pitcher plants (*Nepenthaceae*)
Anthurium plants (*Anthurium* spp.)
Acalypha plants (*Acalypha wilkesiana*)
Succulents (All species of Crassulaceae and Aizoaceae, *Haworthia* spp., *Aloe* spp., *Anacampseros* spp., *Stapelis* spp.)

Republic of the Philippines

Regulations Governing the Importation and Exportation of Plant Materials into and from the Philippines, of 17 September 1954, published as Administrative Order No. 2, Series 1954, in the *Official Gazette* Vol. 50, No. 9, 1954, revoke all previous orders, rules and regulations or parts thereof which are inconsistent with provisions of this Order. They contain the following provisions.

Plant materials requiring permit. Plant materials which are governed by special quarantine orders in force may be imported in limited quantities from countries maintaining plant quarantine and inspection services under permit for propagation purposes or, from countries without plant quarantine and inspection services, under permit and quarantine for experimental purposes. The importation of such plant materials must be made only through the Port of Manila subject to the particular administrative orders governing them.

Application for permit. Applications for import permit must be filed with the Director of Plant Industry on a prescribed form. The permitee should notify the Director on the arrival of plant materials and on subsequent shipment of them.

Foreign certificate of inspection. Importation of fruits, vegetables, seeds and other plant materials must be accompanied by certificates of inspection issued by the government authority of the country of origin, certifying freedom from injurious insects and diseases. In countries without a plant quarantine service, the certificate may be executed by the exporter or shipper, including a statement that the plant materials did not originate from and were not stored in a place infested by injurious insects or diseases, and that the treatment required has been carried out.

Inspection, certification and treatment. The importer must submit to the Bureau of Plant Industry an application for inspection on or before the arrival of the shipment. Imported plants are subject to inspection, treatment, quarantine, refusal of entry and destruction. Plants found to be free from injurious insects and diseases shall be certified and allowed entry.

Freedom from sand, soil or earth. Imported plant materials must be free from sand, soil or earth, and all plant roots, rhizomes, tubers, etc. must be thoroughly washed and so certified. Sand, soil or earth, however, may be used for the packing of bulbs and corms, if it has been sterilized or rendered safe in accordance with prescribed methods and if a certificate to this effect is provided.

Approval of packing material. All packing materials used for the importation of nursery stock and other plants and seeds must be approved by the Bureau of Plant Industry and must not previously be used for packing of living plants. Except for bulbs and corms, they must be free from sand, soil or earth. Certificates to this effect must be provided.

Plant materials not requiring permit. Fruits, vegetables, cereals and other plant products designated for food, or dried or treated botanical specimens, if not the subject of special quarantine orders, may be imported without permit but will be subject to inspection.

Ports of entry. Imported plant materials, except those covered by special quarantine orders, may be imported only through the ports of Manila, Cebú, Iloilo, Zamboanga, Legaspi, Davao, Joló, Aparri, José Punganiban, Tacloban, San Fernando, La Unión and Cagayán de Oro.

News and Notes

European Forestry Commission

The European Forestry Commission held its seventh session at Geneva, 8 to 13 November 1954. Fourteen member governments, seven non-member governments and seven international agencies were represented by delegates and observers.

A secretariat note on the pest and disease situation of forests in 1953, based upon replies to a questionnaire, was circulated. Included in this note are some items of special interest. The Federal Republic of Germany reported that the Spessart beech stands have been ravaged during the past two years by *Dasychira pudibunda*, which defoliates established beech trees completely and hinders regeneration. An area of about 10,000 hectares has been severely affected. In Austria, over 20,000 cubic meters of timber were damaged in 1953 by the Scolytid (*Ips typographus*) in Lower Austria and Carinthia. In the United Kingdom, severe defoliation of young pines over considerable areas in Cannock Forest has been caused by *Bupalus piniarius* and threatening population of this insect also was found in Culbin Forest. The discovery of the needle cast disease (*Rhabdocline pseudotsugae*) on a Vancouver strain of Douglas fir caused some concern, as hitherto it has been found only on strains of inland origin. The infestation of the gypsy moth (*Porthetria dispar*) was severe on oaks in both Portugal and Italy. In the Netherlands, investigations on the resistance of poplars to rust revealed the clones selected in Italy as being highly resistant. In Spain a Forest Protection Service was established in 1953 and undertook to treat 55,000 hectares of forests in 1954. The Austrian Forest Research Institute at Mariabrunn also organized a Forest Protection Section to carry out researches on important pests and diseases.

The Commission also heard with interest the statement of the observer from the Soviet Union that *Endothia parasitica* attacks oak and elm in that country as well as chestnut, and that two experimental stations are actively engaged in investigating methods of controlling its spread.

In accordance with the recommendation of the last session of the Commission, twenty member governments have appointed correspondents to supply current reports on forest pests and diseases to FAO. The Commission urged the correspondents to make regular contributions to facilitate the exchange of such information.

Potato Wart Disease in Western Europe in 1953

On the basis of information received from its member countries, the European Plant Protection Organisation recently reported the 1953 situation of potato wart disease (*Synchytrium endobioticum*) in Western Europe as follows.

The enforcement in most countries of legislation which prohibits the growing of susceptible potato varieties in infested areas has reduced greatly the losses caused by the wart disease. Although the rainy and cold weather which prevailed in the spring and summer in 1953 was favorable to the development of the disease and new outbreaks were reported in Austria, Belgium, the United Kingdom, Denmark, Norway, Sweden and Finland, the incidence of the disease was light in general and the geographic distribution was still restricted to limited areas.

Recently the appearance of a virulent strain of the causal fungus in Western Germany has complicated the preventive measures, as varieties previously known as resistant to this disease succumbed to attack suddenly. Fortunately, new potato varieties resistant to this particular strain have been developed. This strain is not known to exist in any other countries in Western Europe and the legislative measures in force should have provided satisfactory safeguards against its spread.

In general, the potato wart disease thrives best in moderate and cold climates. It has been found in practically all countries in the northern and western parts of Europe, except Luxembourg, the Saar, Jersey, Guernsey and Iceland. In the Mediterranean region, most countries are free from the disease. In Italy and Portugal, infestation was previously detected but the disease apparently failed to become established and there were no outbreaks in 1953. In France, however, localized infestation has become established in the southern parts, i.e., the Departments of Gard, Pyrénées-Orientales and Haute-Garonne.

With regard to its distribution in Eastern Europe, available data are insufficient but the disease is known to exist in Hungary, Poland, the U.S.S.R., Romania and Bulgaria.

Roma - Tip. del Senato del dott. Giovanni Bardi

PLANT BREEDING ABSTRACTS

Plant Breeding Abstracts is a quarterly journal containing abstracts of current literature throughout the world. All publications having a direct or indirect bearing on the breeding of economic plants are mentioned, the fields covered including genetics, cytology, evolution, practical improvement by selection and by more modern methods such as induced mutation and polyploidy, the use of hybrid vigour in raising yields, and the application of interspecific crosses to utilize the valuable genes of wild and indigenous floras. Not only the commoner crop plants are considered but also vegetables, temperate and tropical industrial plants and fruits, and even forest trees. A large section is also devoted to the genetics of microorganisms such as fungi, bacteria and virus, which are of interest both theoretically, as material for study of the basic principles of heredity, and practically, for producing improved strains for brewing and other industrial purposes, and also for building-up disease-resisting forms of agricultural plants.

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